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Social acceptance of the clean energy concept: Exploring the clean energy understanding of Istanbul residents

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ABSTRACT

The energy issue is considered as one of the most important issues on the global agenda not only to meet the increasing energy needs but also for environmental protection and enhancement. Practices on utilizing renewable-clean energy sources and discussions related to these practices have been increasing worldwide. This paper's purpose is to provide empirical data for the deliberation of clean energy and its social acceptance by exploring Istanbul residents' understanding on clean energy. The overall outcome of the conducted survey indicated that Istanbul residents have accepted the clean energy concept at the theoretical level. However, to carry out this acceptance, they should be provided more information and the changes to use them.

Contents

1. Introduction

Worldwide considerations for effective management and protection of the environment to sustain the human systems – in a broader sense, the world ecosystem – and, especially the growing concern about the climate change issue, has been increasingly urging nations and individuals to take measures in energy related issues in order to change the destructive-going direction. As stated elsewhere, in order to reflect on this growing tendency, using alternative (renewable-clean) energy resources has been indicated as one of the ways to decrease human destruction of the world's ecosystem, to some extent. Moreover, clean energy resources have been pointed out as an opportunity to change the fossil energy source based system to a more environment-friendly, renewable system. This change is also, regarded as a way to eliminate harmful greenhouse gas emissions, especially carbon dioxide (CO_2), which is believed to be the major cause of climate change. Because of these issues given, the climate change, the harmful affects of fossil fuels on the environment and the finite nature of non-renewable energy sources, the use of clean energy sources have been increasing rapidly. In 2008, the production of wind energy increased by

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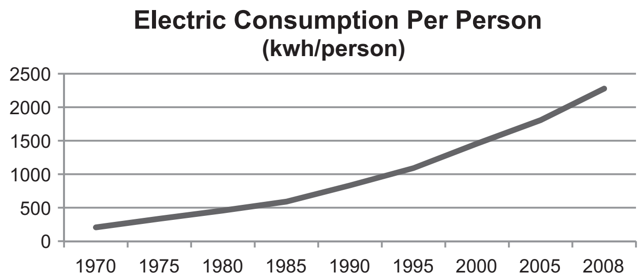


Fig. 1. Electricity consumption increase by years.
Source: Ref. [5].

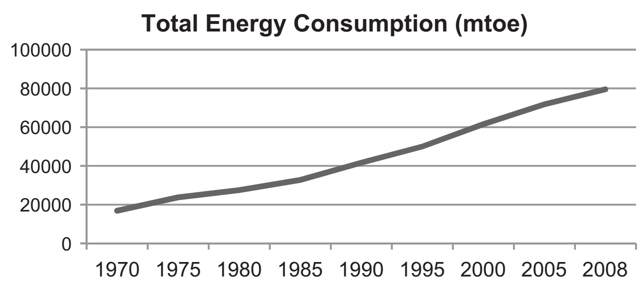


Fig. 2. Total energy consumption by years.
Source: Ref. [5].

30% worldwide, whereas solar energy production increased by 70% [1].

As stated by Neves and Leal [2] a new energy paradigm is emerging in which decentralized energy management is becoming more favorable rather than centralized energy supply. However, a change in paradigm is not an easy task which can be realized in a short period of time because this change depends on many dimensions, including political, technical, social, economic matters, and also requires socio-political action at different levels [2] of society. This paper intends to provide a light on one socio-political dimension by scrutinizing the social acceptance of the Clean Energy (CE) concept in Turkey—specifically by examining Istanbul residents understanding of this concept. To this end, a brief on energy consumption–production in Turkey will be given in the first part, than key concepts in clean energy issues, as well as social acceptance of CE use will be discussed at the theoretical level in the second part. The results of the field work will be presented in the subsequent section. Lastly, the results of the survey will be assessed in the conclusion.

2. Brief on energy consumption, carbon footprint and CE production in Turkey

As with most other countries, Turkey's energy consumption is also increasing rapidly. Between 2007 and 2008, energy consumption in Turkey increased by 1.2% and is equivalent to 1% of the total world energy use [1]. Since 1970 Turkey's electricity consumption per person (Fig. 1) as well as primary energy consumption has been increasing (Fig. 2). Depending on TEIAS data [3], Salvarli [4] indicates that in 2020 energy consumption in Turkey will just reach the level of the present consumption of today's industrialized countries with 5781 kWh per capita.

Even though the gross domestic product (GDP) has been decreasing since 2005, Turkey is one of the countries which has a comparably higher GDP increase among the OECD and Euro zone countries [6] (see Table 1). Besides GDP, Turkey's population is also increasing and the current population of 73 million is expected to be around 84 million in 2020 [7]. Moreover, Turkish citizen's

Table 1
Change of GDP over the years.

	2005	2006	2007	2008	2009	2010 projection	2011 projection
Turkey	8.4	6.9	4.7	0.7	−4.9	6.8	4.5
OECD total	2.7	3.1	2.8	0.5	−3.3	2.7	2.8
Euro area	1.8	3.1	2.7	0.5	−4.1	1.2	1.8
China	11.3	12.7	14.2	9.6	8.7	11.1	9.7

Source: Ref. [6].

consumption habits are changing towards "western style" high consumption. The high growth rate, in collaboration with the growing consumption rate – depending partly on population growth and partly on people's consumption patterns – leads to increasing energy demand in Turkey.

As in the other parts of the world, energy issue has a considerable importance Turkey because of two reasons. First, there is an increasing demand for energy; between 2006 and 2007 the consumption rate increase was 5% (whereas China's increase was 7.7%; OECD countries 0.3%, EU countries −2.2%) [8]. Second, and most significant, Turkey has limited fossil fuel resources which create dependency on other countries for the supply of energy. According to the Ministry of Energy and Natural Resources (MENR) statistics [5], in 2008, 75% of the energy supply was imported, and only a quarter of the energy supply was provided by the domestic energy sources. Because of this high dependency on import, the current and previous governments have been putting a special interest in supplying energy from different countries and utilizing more domestic energy production by making available new energy sources, like nuclear, wind and solar energy. Moreover, they have been expanding the possibilities for more extraction of coal and petroleum with the use of new technologies—which brought by international firms.

The increasing energy demand not only creates a large interest among the public and government but also a discussion among environmentally concerned individuals and groups because of its negative impact on the environment. Environmentally concerned groups and individuals' interest on the energy issue is based on two points: the plans to utilize nuclear power and the use of fossil fuels which creates environmental problems—especially their negative contribution to climate change. The government's continuing attempt to build a nuclear power plant has created tension. Environmental groups and local residents oppose these plans and ask for more environmental-friendly energy alternatives like wind and solar energy. The other discussion point of environmentalists is the increasing use of fossil fuels. However, Turkey's carbon footprint (based on energy related CO_2 emissions) is not as high when looked at from a comparative perspective. Turkey's carbon footprint share on the world scale is 0.8%, whereas this rate is 21% for the USA, 3% for Germany, 17% for China and around 2% for Mexico [9]. Even though the abovementioned rate is not considerably serious today, Turkey's energy demand and population increase is expected to cause a higher carbon footprint in the future. For example, within total energy consumption, the use of petroleum increased 5.8% between 2007 and 2008 whereas worldwide petroleum use decreased by 0.6% for the first time in a decade [1]. The environmentally concerned groups argue that the Turkish government has a minor interest in decreasing the nation's carbon footprint.

On the government's side, besides the tendency to develop a strategy to use cheap and available energy resources—regardless of their impact on the environment, there are attempts to utilize alternative (renewable-clean) energy sources. So there is a certain amount of production from these types of sources. However, their use is very limited. As of 2008 over 90% of energy is supplied from non-renewable fossil fuels whereas only 1% of total energy is supplied from renewable-clean resources (Fig. 3). Considering the fact that Turkey has an advantageous geographical location for

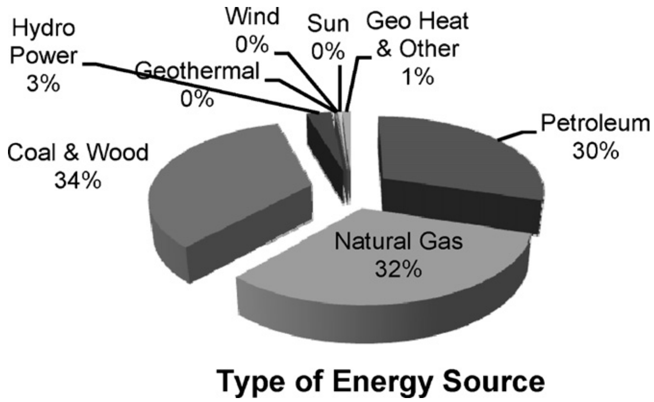


Fig. 3. Type of energy source in 2008 energy supply.
Source: Ref. [5].

extensive use of clean energy sources [10], especially wind and solar, this amount can be considered as an indication of underuse. Özgür [11] notes that Turkey has an extensive shoreline, mountains and a Mediterranean climate which create a potential for clean-renewable energy use, yet it requires investment and legal/financial support for R&D activities. Özgür projects that renewables will have a share of about 23.68% in 2020 [11]. Furthermore, it is also indicated that in order to meet the challenges of heavy dependence on energy imports, finite reserves of fossil fuels, rapid rise in energy prices and environmental issues, Turkey should see renewable energy as the key towards a solution [12].

Therefore, at least at the theoretical level, utilizing more CE resources is desirable among environmentally concerned people in Turkey at least for two reasons: clean domestic energy can provide independence and, considering the fact that Turkey's energy consumption and carbon footprint is increasing, use of CE sources can help to eliminate greenhouse gases.

3. CE and its social acceptance

Today, as reflected in Turkey's discussions on energy, the energy issue has a significant place in the world for similar reasons. The availability of energy resources is related to the alarming condition of non-renewable energy sources and the global climate change. Mainly because of these two reasons sustainability of energy resources and advancement of clean energy resource-use have gained a special interest in different parts of the world, and the necessity for the transition of the global energy system [13]. Before elaborating on social acceptance of clean energy, it is necessary to specify some of the arguments related to the definition of clean energy for they are a subject for debate and also because it provides important information about social acceptance.

3.1. The context of CE

Energy, which "...is the capacity, or ability to do work... is not itself a thing or a substance" [14], and it is mandatory to use some supplies, devices to reveal the energy for human use. The sources of energy can be different; however, since the beginning of industrialization, the use of non-renewable resources or fossil fuels has been dominant throughout the world. The technical definition of fossil fuels is "incompletely oxidized and decayed animal and vegetable materials, specifically coal, peat, lignite, petroleum and natural gas" [15]. According to this definition the main fossil fuels can be listed as petroleum, natural gas and coal. Although there are variations, in broad terms, renewable energy can be defined as "the use of any storage reservoir which is being 'refilled' at rates comparable to that of extraction" [14]. In this broad definition renewable energy sources refers to hydro, biomass, solar, wind, geothermal, ocean [16] and nuclear energy. Lastly there are renewable energy sources which is termed as 'new renewables' [16] or as clean energy. These terms "...suggest a greater focus on modern and sustainable forms of renewable energy" [16] which have relatively less effect on the environment and on society. So, the list of renewable energy sources is shortened by eliminating large-scale hydropower – only welcoming small-scale hydropower – and also by eliminating nuclear power. The sources in this case are solar, wind, wave, small-scale hydro power, biomass, ocean power (tidal, wave, ocean thermal, marine biomass energy), geothermal [13] and hydrogen. As a result, these renewable energy types are considered as clean energy sources.

The same discussion is detailed within the framework of the Sustainable Development approach. In this approach, one group indicates that in order to ensure sustainability humans have to use all kinds of energy sources, which might be harmful to the environment. Representing this idea, Tester et al. [17] define sustainable energy as "a dynamic harmony between the equitable availability of energy-intensive goods and services to all people and the preservation of the earth for future generations", and deliberate that "...[f]or a more sustainable energy future we need to develop a rich set of energy technology and technology-intensive policy options. These options include increased efficiency of energy production and use, reduced consumption, a new generation of renewable energy technologies, nuclear options that can win and retain public acceptance, and means to use fossil fuels in a climate-friendly way" [17]. At the other end, another group accepts only the sources that do not carry extensive risk and harm on the environment, and claim that the energy sources we use should be not only be renewable but also harmless to ensure sustainable development in the long term. According to this view sustainable energy cannot be thought "of simply in terms of availability relative to the rate of use" [18], we should also consider other aspects within the context of the ethical framework of sustainable development, which includes environmental effects, the question of wastes (even if they have no environmental effect), safety and available options for future generations [18]. As a result, the latter group only supports clean-renewable energy sources and rejects large-scale hydropower dams and nuclear energy use.

Another important issue related to the clean energy concept is energy efficiency. It is indicated that the use of clean energy is not enough; besides utilizing environment friendly renewable energy resources, it is equally important to use produced energy efficiently and if possible, to reduce the energy use by changing our habits. Although, energy efficiency and conservation is not the primary subject of this article, because of its importance, it is considered as a part of the clean energy concept.

3.2. Social acceptance of CE—importance of public awareness

Environmental issues, generally, present the problem of complexity where sometimes not all of the dimensions can be included in the related processes or because of their nature, these are issues dominantly perceived as scientific problems. Frequently, environmental issues are solely examined under natural sciences or engineering sciences or mainly within the economic dimension. For example, as argued in adapting human settlements to endure changing climatic conditions [19], dominant scientific perspective bounded with specialized and complicated knowledge may create exclusion of social scientists (including planners) in the mitigation/adaptation practices for planning [19,20]. Furthermore, Laukkonen et al. [21] note that a comprehensive approach which embraces local socio-economic aspects in developing climate change strategies is crucial in sustainable development practices. Likewise, in the establishment or enhancement of an

energy system, a complex and wide range of issues have to be considered. Thus, social acceptance of clean energy needs to be scrutinized not only from an engineering or managerial perspective but also within a broader framework. The literature on social acceptance indicates that there can be a number of dimensions in this concept. Wüstenhagen et al. [22] note that these dimensions are threefold: Socio-political acceptance (of technologies and policies, by the public, by key stakeholders, and by policy makers), market acceptance (of consumers, investors, and intra-firm), and community acceptance (Procedural justice, distributional justice and trust). Socio-political acceptance, according to Wüstenhagen et al. [22], represent the broadest framework. This framework, however, needs detailed examination regarding specific issues because there may be significant differences between the policies and their implementation. Hence, institutionalization and collaborative decision-making supported spatial planning system is necessary [22]. The studies on energy related social acceptance focus in general on renewable energy systems (see Ref. [23]), on occasion on one system (see Ref. [24]) and in terms of technological innovation. Although there are differences between countries, all of these studies point to the conclusion that public awareness and concern has a significant place in social acceptance.

Before scrutinizing the results of the survey, it is worthwhile in examining studies related to public concern/awareness on environmental issues in Turkey and specifically in Istanbul in order to have a base discussion of public acceptance of the CE concept. A 1998 study which scrutinized environmental concern among Istanbul residents found that although Turkey is a developing country, a considerable environmental concern exists contrary to expectations [25]. According to this study demographic parameters did not play a significant role in level of environmental concern. However, respondents' spatial perception and environmental knowledge are linked to their environmental concern.

Another study from a different perspective states that in Turkey, economic dependency is the key factor in the establishment of environmental attitudes [26]. According to Ignatow [26] "an explanation based on dependency theory, rather than on theories of class conflict or post materialism, can best account for how economic processes influence public opinion" (648). In contrast with Ingelhart's (1995) claim that economic development affects environmentalism by changing individual or cultural values, this study [26] suggests that ". . .in developing nations especially, environmental concern is indeed a product of national wealth, but indirectly" (p. 648). Ignatow furthers that Turkish citizens and civil society groups are environmentally aware and active, however, since Turkey is bounded with foreign investors and the decisions of international institutions, environmental awareness and activism is limited due to restricted democratic processes [26]. Yet, another study, which explores Istanbul residents' environmentalism reveals that Istanbul residents are environmentally concerned about general (national level) issues if they were provided information, but they are not so familiar and concerned about local environmental issues [27]. Under the light of this examination and previous studies and discussions, this paper will explore Istanbul residents' awareness about the CE concept as an indicator of social acceptance, and present empirical data with the survey results.

4. Social acceptance of clean energy in Istanbul: survey results

A survey, which aims to reveal some understanding about the extent of knowledge and awareness related with the CE concept among Istanbul residents was designed and realized in 2009. The survey was expected to provide a basis in the discussion on social acceptance – specifically public acceptance – of the CE concept in Turkey.

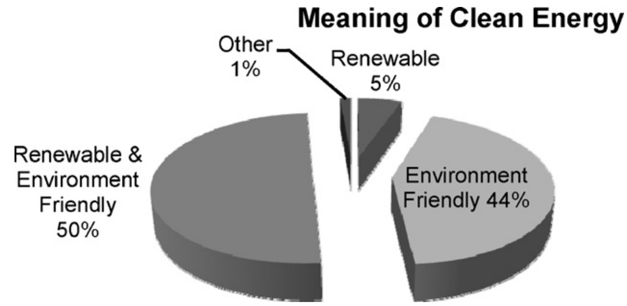


Fig. 4. Meaning of CE concept according to the participants.

The survey study was held with the assistance of a sociologist who has experience in field studies in order to have high academic quality and dependability. The survey was realized in two steps: a preliminary survey was completed by questioning fifty individuals from different neighborhoods. Upon the examination of the results of these questionnaires, it was agreed that conducting an additional one hundred questionnaires was necessary in order to have a satisfactory sample which can represent the general trends of Istanbul habitants. A total of one hundred and fifty participants were randomly selected from different neighborhoods of Istanbul to include different socio-economic segments. Since Istanbul has many central districts, the five most important city sub-centers were chosen to conduct the survey. Şişli, Beşiktaş, Kadıköy, Beyoğlu, Eminönü neighborhoods are most favorable social gathering centers for shopping or recreation. Within these neighborhoods, shopping centers or gathering places were chosen to complete the questionnaire because the goal was not only to ask questions to the habitants of these neighborhoods but also include participants who are living in different parts of the city. The results were satisfactory in this sense and participants from twenty-two different neighborhoods were included in the study. Furthermore, in this way, it was possible to embrace different socio-economic segments of the Istanbul society. The results of the survey also revealed that the participants have a heterogeneous profile as indicated in the analysis below.

The survey questions were asked to the participants to uncover whether Istanbul residents have awareness about the CE concept and its context. Besides this major issue, participants were also questioned as to whether they can relate to the concepts of CE and energy efficiency. Moreover, in its original form, the survey was designed to disclose whether the participants can interrelate to the sustainable development approach and clean energy concepts. However, because of the purpose of this article, only the clean energy concept related questions results are presented here.

4.1. Knowledge and awareness about the clean energy concept

In terms of understanding the knowledge and awareness on the CE concept, participants were asked two major questions. First, what is the meaning of the CE concept and second, how they list and rank CE sources. Following these two main questions the respondents were also asked questions on energy efficiency and its relation to the CE concept. The results of these questions are briefly presented in this paper.

4.1.1. The context of CE

In indicating the variable meanings of clean energy, participants were given four options: renewable, environment friendly, renewable and environment friendly, and other. In correlation with the clean energy description – given in the first part of this article – which is renewable and harmless to the environment – it was expected that participants would choose the third option. As shown

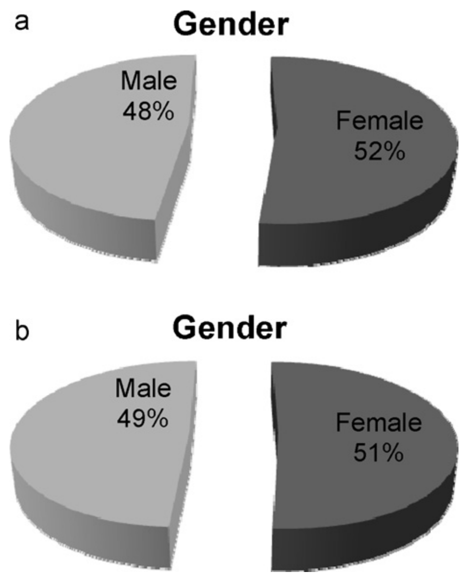


Fig. 5. (a) Gender of the total participants, (b) gender of the participants who are fully aware of CE.

in Fig. 4, 50% of the participants indicated that CE is both renewable and environment friendly energy, 44% indicated environment friendly energy, and only 5% thought that it was renewable energy. The result primarily showed that 90% of the participants thought CE as an energy type which was not destructive to the environment. Half of the participants were aware of the ideal context of the concept that not only should it include environment friendliness but also renewability.

In order to understand the possible reasons to have awareness for the CE concept, it is crucial to examine the profile of the participants who said that CE came from renewable and environment friendly energy sources. The profile of the survey participants was examined according to their gender, age, education, personal income and their marital status. In the following section each of these points is presented: first, for all of the participants (shown as Fig. Xa) and then only for the participants who chose the "renewable and environment friendly" option to explain the context of the CE concept (shown as Fig. Xb).

4.1.2. Gender and age

The survey results indicated that nearly half of the total participants were male whereas the number of female participants was slightly more than the male participants (Fig. 5a). The gender ratio within the fully aware about CE concept group was not so different from the total participants (Fig. 5b). Therefore, gender did not play a crucial role in being more aware about the CE concept.

Another important issue relating to the profile of the participants was age. According to the results, among all of the participants, most of them were in their middle ages (Fig. 6a). All of the age groups were divided nearly equally. However the most dominant groups were gathered between the 25–35 age and 40–50 age groups. This equal division changes within the age groups of the participants were fully aware of the CE concept (Fig. 6b). The most dominant age groups were those between 30–35 ages and 40–50 ages. Interestingly, the ratio of young participants and a part of the mid-age group (35–40) were relatively smaller compared to the other age groups.

Generally, it can be stated that the number of participants in the second group were very closely distributed in terms of their age-groups, and there was a slight dominance of participants who were over age thirty.

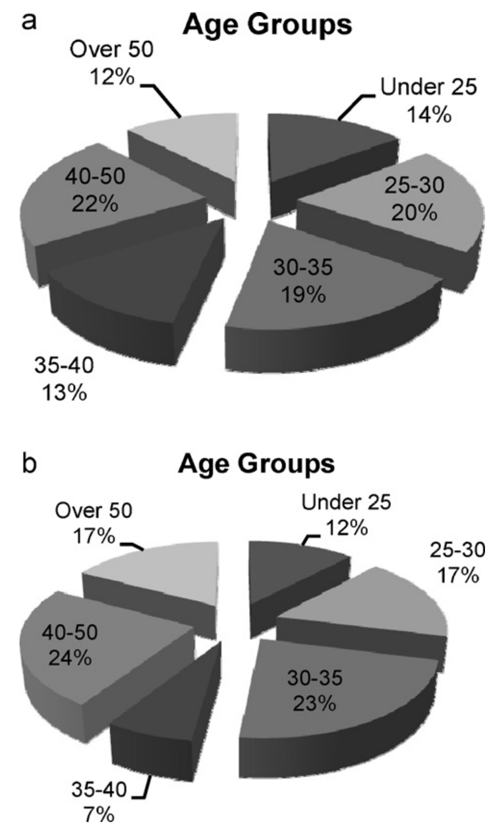


Fig. 6. (a) Distribution of age groups among the total participants, (b) distribution of age groups among the participants who are fully aware of CE.

4.1.3. Education and personal income

At the beginning of the study, as very frequently discussed in the literature, it was expected that awareness had a direct relation with the education of the individuals. The survey results were examined with this expectation and it was seen that education among the total participants was considerably high. The survey indicated that half of the participants had higher education (Fig. 7a). This percentage was even higher among the participants who were fully aware of the CE concept; the total rate of university and graduate level education was 57% among this group (Fig. 7b).

However, as an interesting point, the constant rate of awareness within the primary school graduates should be specified. Within total participants, the ratio of primary school graduates was 13% whereas this ratio was 12% within the total participants who were fully aware of CE. If awareness increased with the increase of education it should be expected that the ratio of primary school graduates should be decreasing whereas the number of high school graduates should be increasing. However, as seen in the graphs (Fig. 7a and b), this was not the case. This result suggests that it was accurate to accept that awareness increased with the increase in education level. However, there are other issues that should be taken into account because education was not the main determinant at least among the survey group.

The survey results indicated that the personal income of the total participants was generally low or upper low (Fig. 8a). There was no important difference among the participants who were fully aware of the CE concept. The only distinction between these groups was the slight decrease in the upper low and low income groups of the participants who were fully aware of CE and this was parallel to their education level. It can be noted that the general conclusion from this point can be "having a high-income is no guarantee to having a higher awareness about the CE concept". Furthermore, after scrutinizing the group who are fully aware of the CE

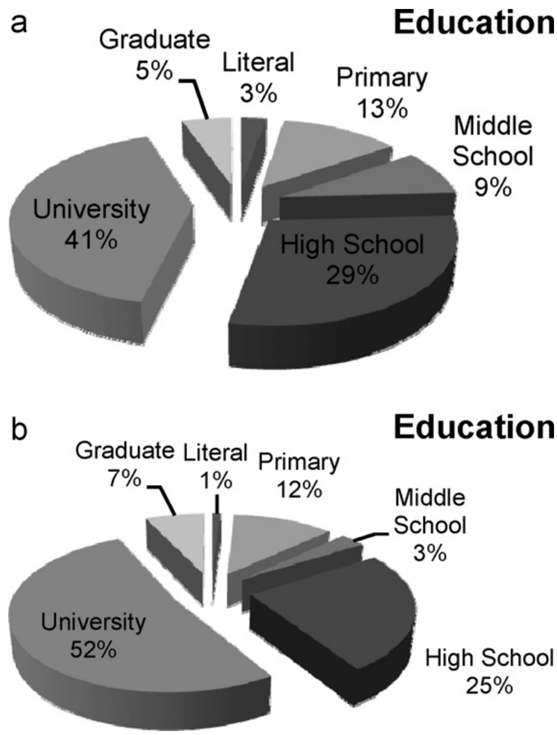


Fig. 7. (a) Education among the total participants, (b) education among the participants who are fully aware of CE.

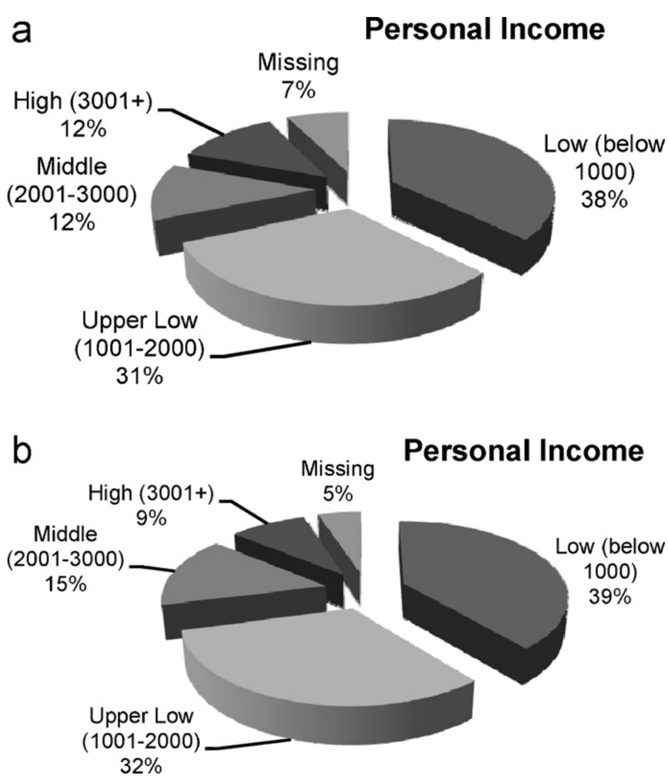


Fig. 8. (a) Personal income of the total participants, (b) personal income among the participants who are fully aware of CE.

concept (Fig. 8b) it is possible to add that contrary to expectations, low and upper low income individuals can have higher awareness, even though there is a very slight increase. Although this minor increase is not critical to make a further study, it calls for asking the question of "what could be the reason(s) behind this increase?" as was the case of the level of education.

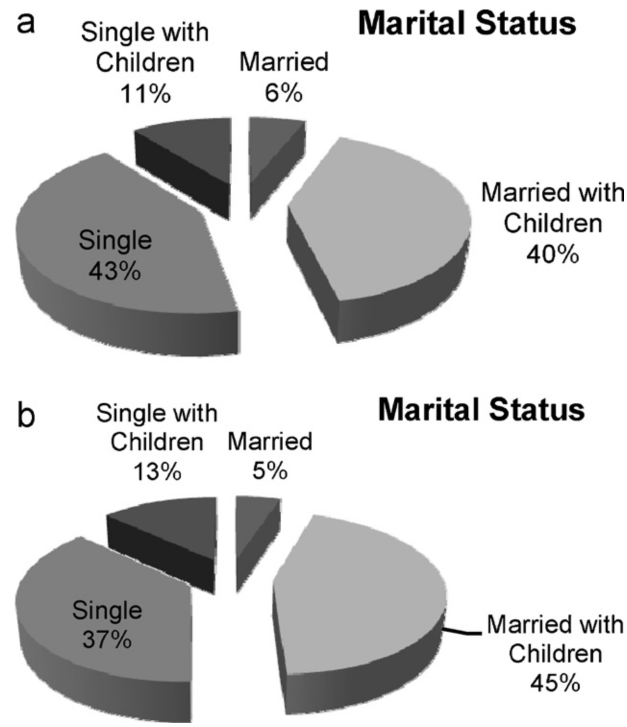


Fig. 9. (a) Marital status of the total participants, (b) marital status among the participants who are fully aware of CE.

4.1.4. Marital status

Lastly, marital status of the participants is taken as another part of the profile. Lastly, marital status of the participants was taken as another part of the profile. According to the survey, the majority are either single or married with children in both groups (Fig. 9a and b). However, the number of individuals who are single with children or married with children is increasing among the participants who are fully aware of CE (Fig. 8b). This increase is not that significant – the percentage of single with children raised 2 points, married with children raised 5 points – but it helps to answer the question in education and personal income level. The escalation indicates that individuals who have relatively low income and education may have a somewhat higher awareness about the CE concept as they have children. The important connection with the future (children) drives individuals to be more aware of the issues which are and will be crucial for their children. Thus, in this study, marital status is revealed as an important issue which can help to appropriately examine the social profile of the participants.

4.1.5. The listing and ranking of CE sources

Secondly, the participants were asked to rank "clean energy sources" according to their importance. Nine different energy resource types were provided to the participants, and were asked to choose the foremost five clean energy sources and list them first being the cleanest one. The list of different types of energy sources included clean energy sources and also renewable and/or fossil fuels, ranging from various types of resources to other renewable and fossil fuels. These resources were listed randomly as coal, wind, solar, petroleum, hydraulic (hydropower), geothermal, biomass/biogas, natural gas, hydrogen, and other. Since the list also included non clean energy sources, participants were expected to pick clean energy types in the first step, and then rank them. Thus, in this two-step answering session, participants were expected to disclose their knowledge on the differentiation of clean energy and non-clean energy sources, and construct their listing accordingly.

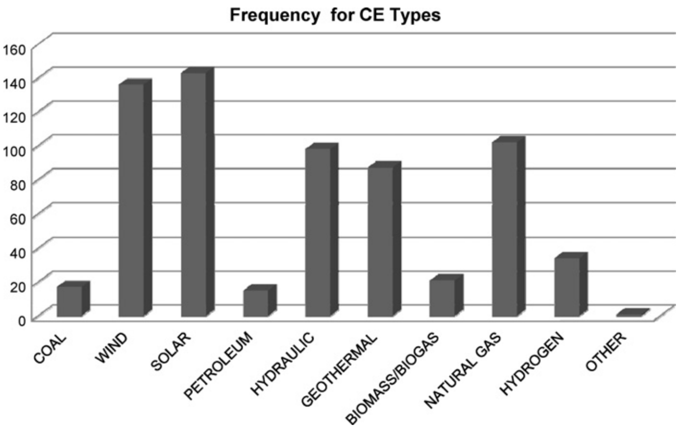


Fig. 10. Frequency in selection of clean energy listing.

The result of this question was two-fold. The first outcome is about the participants' linking theory and practice. As discussed in the previous section most of the participants were aware of the importance of the environment in energy provision, and half of them were successful to point out the ideal definition of the CE concept (that is renewable and environment friendly). This second question is helpful in understanding the extent of their presented knowledge on this issue, and in revealing whether the participants know CE energy sources and be able to list them correctly. According to the survey results, participants select all of the presented energy sources and put them in their listing.

In Fig. 10 and Table 1 the number of participants who selected the specific energy sources is given. This chart presents the selection frequency of energy sources. According to the results to this question, the participants most frequently listed solar and wind as clean energy sources. The ranking for the frequently listed energy sources is: 1. Solar, 2. Wind, 3. Natural gas, 4. Hydraulic, 5. Geothermal, 6. Hydrogen, 7. Biomass/biogas, 8. Coal, and 9. Petroleum. The significance of this result is that some participants picked non-renewable/not-environment-friendly energy sources as CE sources in their listing. Even though they did not put these on the top of their list, they considered them as a CE source.

In this listing there are two expected points. Even though, at the theoretical level, participants present a high awareness about CE concept, at the practical level the meaning of CE is not correctly perceived by many of the participants. Therefore, the participants included petroleum, coal and natural gas, the most-known fossil fuels, in their CE sources listing. Second, it is also not surprising to see hydropower as a CE source because the public does not have enough knowledge about possible negative impacts of large-scale hydropower on the environment. Even though there has been a rising public discussion on this issue, the non-effected part of the society is not so aware of this debate, only environmentalists and individuals who have been affected or will be affected show interest on this issue.

In this listing there is an unexpected result namely, the inclusion of natural gas as a CE source in the listing with a high frequency-102 participants out of 150. This is an unexpected result; however, the reason behind this outcome is understandable since there is a social experience related to this issue: At the beginning of the 1990s, especially large cities in Turkey were faced with heavy air pollution, which considerably reduced the quality of life and created serious health problems. Starting from the capital, Ankara, and the largest metropolitan area in the country, Istanbul, the government introduced natural gas and built the infrastructure accordingly. With the use of natural gas, these cities were rescued from the enormous impact of air pollution and, still in most mid-size cities local governments try to initiate natural gas infrastructure to dispose of air pollution created by the use of other fossil-fuels, coal and petroleum. Thus, it is very normal to see that Istanbul residents (as a part of the Turkish public) perceive natural gas as a CE source (Table 1).

Table 2
The number of participants who select the energy sources/frequency in selection of CE.

Type of energy source	Number of participants who selected the type	Ranking
Solar	143	1st
Wind	136	2nd
Natural gas	102	3rd
Hydraulic	98	4th
Geothermal	87	5th
Hydrogen	34	6th
Biomass/biogas	21	7th
Coal	17	8th
Petroleum	15	9th
Other	1	10th

Another point raised from the frequency listing is biomass/biogas. Contrary to expectations, biomass/biogass, as one of most the well-known and used CE sources in Turkey, was not frequently chosen. Speculatively, two reasons can be associated with this result. Firstly, participants do not know the general name of this CE source although they use it in their daily life. Secondly, the effective drive can be related to the discussion about the possible negative effects of growing specific biosources to produce biogas, especially the loss of agricultural land. It is interesting to note that participants more frequently chose hydrogen than biomass/biogas (Table 1) even though hydrogen is the least used CE source in Turkey.

The second examination in this question is related with the ranking of CE sources. Participants also ranked the sources according to their importance. The first being the cleanest one, participants ranked five energy sources. As seen Table 2, out of 143 participants who consider solar energy as a clean source, 87 participants listed solar energy as the first/most important clean energy source. Following solar, wind is indicated as the second most important CE source according to 66 participants. After solar and wind, hydraulic is indicated as third, whereas geothermal as fourth and natural gas as fifth.

Table 2 presents detailed data on the rankings. It can be observed that the ranking is very close to the frequency listing. The only difference is the placing of natural gas. In the frequency listing natural gas is listed in third place, however, in the ranking it is listed in fifth place. This dissimilarity shows that even though the participants perceived natural gas as a CE energy source, they did not consider it as the cleanest one. So, the place of natural gas was lowered when the participants were asked for the ranking of the CE sources. In this way, participants corrected their perception to a certain extent (see Table 3).

4.1.6. *Energy efficiency*

Survey participants were also asked about the relationship between energy efficiency and the CE concept: 97% of the respondents indicated that there is a relation with the CE concept and energy efficiency. Among this group, nearly half of them, 45%, pointed out that they give importance to the positioning of their flat/house in order to have enough sunlight, and more than a third of them, 37% stated that they consider the positioning, the use of energy saving appliances and materials in their home, regardless if they own the property or rent it. Lastly, and possibly more importantly, 80% of the participants declared that they are willing to pay more for energy efficiency, especially for electrical appliances using energy saving building materials; using clean energy devices (like solar panels) and using more environment friendly cars (like hybrid cars).

Table 3
The ranking of clean energy types and their selection frequency.

Energy Type/ Ranking	Solar	Wind	Hydraulic	Geothermal	Natural Gas	Biomass/ Biogas	Hydrogen	Coal	Petroleum
1st	87	27	9	4	16	4			2
2nd	35	66	14	8	18	3	2	2	1
3rd	13	23	39	21	26	3	5	5	5
4th	7	12	26	33	21	6	2	2	4
5th	1	8	10	21	21	5	18	8	3
Total	143	136	98	87	102	21	34	17	15

5. Concluding remarks

The conducted survey provided empirical data for Istanbul residents' CE concept understanding, and revealed some significant results. The primary result of this study is that, in general, Istanbul residents have knowledge about the CE concept. As indicated before, 90% of the participants think that the CE concept is related with environmental friendliness and half of them are aware of the ideal context of the concept that not only should include environment friendliness but also renewability.

Within the most the CE concept aware group it is seen that this awareness has a relation with demographic parameters to some extent. The survey reveals that gender, age and personal income do not strongly stimulate awareness about the CE concept: The evidence from the study only suggests that being over 30 years old and being the member of middle/upper-low income groups may have a weak affect. On the other hand, the evidence suggests that education and marital status have a moderate function in the awareness level; they do not change the whole landscape but play a modest role. Accordingly, the data shows that awareness increases with the level of education, and a correlation exists between marital status and the awareness level. Especially the second point, marital status is important because it reveals that having a family, specifically having children, intensify future related assessments, consequently, considerations for leaving a liveable place to future generations drive individuals to make an effort to understand new and alternative ways to live, as in the case of the CE concept.

The third outstanding point of the study is that Istanbul residents have knowledge about the CE concept, at the general level however, its extension is limited. When the participants were asked about the types of CE sources, they indicated fossil fuels as CE sources, and even selected natural gas in third place in terms of frequency. Moreover, participants listed biomass/biogas in the lower ranks, even though this CE source is the one of the most frequently used energy source in Turkey. Therefore, the evidence suggests that Istanbul residents are open and ambitious to be aware about the CE concept but due to their limited knowledge and limited experiences the detailed context about the concept is also limited. The answers to energy efficiency support this finding because the participants are knowledgeable enough about energy efficiency use and its relation with the CE concept. The key point here might be related with experience if individuals have some experience related to the concepts and their context directly in their life, their awareness is higher. Regardless of the demographic parameters, if the individuals are provided more chances to use CE sources in their daily life with the help of more information by the government or the media, they might be expected to have a higher level of awareness.

Another finding of the study is about validation of preoccupations. The survey results showed that the most common preoccupation: "Awareness about the SD concept and clean energy concepts is expected to be higher with the education level" is validated to some extent. Moreover, another initial preoccupation that 'marital status, especially having children, raises the awareness on these kinds of concepts—which is related to the quality of life/sustainability of future generations' is clearly validated.

As a last remark it should be indicated that, even though there could be some differences between different social segments, generally, Istanbul residents have acceptance for the CE concept and its use. However, in order to fulfill the context of this concept they should be provided with more information and the chance to use them in their daily life. A further study which examines the government's and market's attitude/opinion can show us the possible ways to achieve this purpose.

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